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EXAMINER	
FLORES, LEON	

ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/516,714	LE NIR ET AL.	
	Examiner	Art Unit	
	LEON FLORES	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _02 December 2004_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-11_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-11_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _02 December 2004_ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The substitute specification filed must be accompanied by a statement that it contains no new matter.

3. The disclosure is objected to because of the following informalities: In page 7, lines 19-20 the word "divided" should be replace by "multiplied".

Appropriate correction is required.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 11 is rejected under 35 U.S.C. 101 because of the following reason:

The interim guidelines states that:

"A claim that recites nothing but the physical characteristics of a form of energy, such as a frequency, voltage, or the strength of a magnetic field, define energy or magnetism, per se, and as such are nonstatutory natural phenomena. O'Reilly, 56 US (15 How.) at 112-14."

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Claims (1 & 9) are rejected under 35 U.S.C. 102(b) as being anticipated by Maryline Helard et al. (hereinafter Helard) "Reduced-Complexity Space-Time Block Coding and Decoding Schemes with Block Linear Precoding" Electronic Letters July 2003.**

Re claim 1, Helard discloses a method for sending a signal formed by successive vectors each comprising N symbols to be sent, and implementing at least two transmitter antennas, wherein a distinct sub-matrix is associated with each of said antennas, said sub-matrices being obtained by subdivision of a unitary square matrix, and each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, so as to form, as seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix. (See page 1066 col. 2 – page 1067 col. 2)

Re claim 9, A method for the reception of a signal corresponding to the combination of contributions of each of at least two transmitter antennas, a distinct sub-matrix being associated with each of said antennas, said sub-matrices being obtained by subdivision of a unitary square matrix, wherein each of said antennas sends sub-

vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, and wherein the signal forms, seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix, wherein the method implements at least one receiver antenna, receives said single combined signal on each of said receiver antennas, and decodes said single combined signal by means of the decoding matrix corresponding to a matrix that is the conjugate transpose of said unitary matrix. (See page 1066 col. 2 – page 1067 col. 2)

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. **Claims (1-3 & 9-10) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn et al (hereinafter Ahn) (US Publication 2006/0291374 A1) in view of Hochwald et al. (hereinafter Hochwald) (US Patent 6,363,121 B1)**

Re claim 1, Ahn discloses a method for sending a signal formed by successive vectors each comprising N symbols to be sent, and implementing at least two transmitter antennas, wherein a distinct sub-matrix is associated with each of said antennas. (See fig. 1)

But the reference of Ahn fails to teach that said sub-matrices being obtained by subdivision of a unitary square matrix, and each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, so as to form, as seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix.

However, Hochwald does. (See fig. 1 & col. 2, lines 35-67, col. 3, lines 33-40 & col. 4, lines 5-39) Hochwald discloses a system that uses unitary spce-time signals wherein said sub-matrices being obtained by subdivision of a unitary square matrix ("multiply by an unitary matrix"), and each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, so as to form, as seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix. (See fig. 1)

Therefore, taking the combined teachings of Ahn and Hochwald as a whole, it would have been obvious to one of ordinary skills in the art to incorporate these features into the system of Ahn, in the manner as claimed and as taught by Hochwald, for the benefit of reducing the error rate of received signals.

Re claim 2, the combination of Ahn and Hochwald further disclose implementing Nt antennas, wherein each of said sub-matrices has a size of (N/Nt)X.N. (In Hochwald, see fig. 1)

Re claim 3, the combination of Ahn and Hochwald further discloses wherein N/Nt is greater than or equal to 2. (In Hochwald, see fig. 1)

Re claim 9, Ahn discloses a method for the reception of a signal corresponding to the combination of contributions of each of at least two transmitter antennas, a distinct sub-matrix being associated with each of said antennas. (See fig. 1)

But the reference of Ahn fails to teach that said sub-matrices being obtained by subdivision of a unitary square matrix, wherein each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, and wherein the signal forms, seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix, wherein the method implements at least one receiver antenna, receives said single combined signal on each of said receiver antennas, and decodes said single combined signal by means of the decoding matrix corresponding to a matrix that is the conjugate transpose of said unitary matrix.

However, Hochwald does. (See fig. 1 & col. 2, lines 35-67, col. 3, lines 33-40 & col. 4, lines 5-39) Hochwald discloses a system that uses unitary spce-time signals wherein said sub-matrices being obtained by subdivision of a unitary square matrix,

wherein each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices ("multiply by an unitary matrix"), and wherein the signal forms, seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix, wherein the method implements at least one receiver antenna, receives said single combined signal on each of said receiver antennas (See fig. 1), and decodes said single combined signal by means of the decoding matrix corresponding to a matrix that is the conjugate transpose of said unitary matrix. (See col. 6, lines 4-61)

Therefore, taking the combined teachings of Ahn and Hochwald as a whole, it would have been obvious to one of ordinary skills in the art to incorporate these features into the system of Ahn, in the manner as claimed and as taught by Hochwald, for the benefit of reducing the error rate of received signals.

Re claim 10, the combination of Ahn and Hochwald further disclose wherein a maximum likelihood decoding is applied to the data coming from the multiplication by said conjugate transpose matrix. (In Hochwald, see col. 6, line 4-61)

10. **Claims (4-8) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn et al (hereinafter Ahn) (US Publication 2006/0291374 A1) and Hochwald et al. (hereinafter Hochwald) (US Patent 6,363,121 B1), as applied to claim 1 above, and further in view of Boariu et al. (hereinafter Boariu) (US Patent 6,865,237 B1)**

Re claim 4, the combination of Ahn and Hochwald fails to teach that wherein said unitary matrix is full.

However, Boariu does. (See equation 53 & 55) Boariu discloses that wherein said unitary matrix is full.

Therefore, taking the combined teachings of Ahn, Hochwald and Boariu as a whole, it would have been obvious to one of ordinary skills in the art to incorporate these features into the system of Ahn, as modified by Hochwald, in the manner as claimed and as taught by Boariu, for the benefit of optimizing the minimum-to-average power. (See col. 22, line 46 - col. 23, line 2)

Re claim 5, the combination of Ahn, Hochwald and Boariu further disclose wherein said unitary matrix belongs to the group comprising: the real Hadamard matrices; the complex Hadamard matrices; the Fourier matrices; the real rotation matrices; the complex rotation matrices. (In Boariu, see equation 53)

Re claim 6, the combination of Ahn, Hochwald and Boariu further disclose wherein implements two transmitter antennas and said sub-matrices have a value of [1 1] and [1 -1]. (In Boariu, see equation 53)

Re claim 7, the combination of Ahn, Hochwald and Boariu further disclose wherein the method implements two transmitter antennas and said sub-matrices have a value of

$\frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \end{bmatrix}$ and $\frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$.

(In Boariu, see equation 53)

Re claim 8, the combination of Ahn, Hochwald and Boariu further disclose wherein the method implements four transmitter antennas and that said sub-matrices have a value $[1\ 1\ 1\ 1], [1\ -1\ 1\ -1], [1\ 1\ -1\ -1]$ and $[1\ -1\ -1\ 1]$.

(In Boariu, see equation 53)

11. **Claims (1 & 9) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn et al (hereinafter Ahn) (US Publication 2006/0291374 A1) in view of Kai-Kit Wong et al. (hereinafter Wong) "A Joint-Channel Diagonalization for Multiuser MIMO Antenna Systems", IEEE July 2003.**

Re claim 1, Ahn discloses a method for sending a signal formed by successive vectors each comprising N symbols to be sent, and implementing at least two transmitter antennas, wherein a distinct sub-matrix is associated with each of said antennas. (See fig. 1)

But the reference of Ahn fails to teach that said sub-matrices being obtained by subdivision of a unitary square matrix, and each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, so as to form, as seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix.

However, Wong does. (See section 2 & fig. 1) Wong suggests that said sub-matrices being obtained by subdivision of a unitary square matrix, and each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, so as to form, as seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix.

Therefore, taking the combined teachings of Ahn and Wong as a whole, it would have been obvious to one of ordinary skills in the art to incorporate these features into the system of Ahn, in the manner as claimed and as taught by Wong, for the benefit of optimizing the communication link between the base station and mobile station.

Re claim 9, Ahn discloses a method for the reception of a signal corresponding to the combination of contributions of each of at least two transmitter antennas, a distinct sub-matrix being associated with each of said antennas. (See fig. 1)

But the reference of Ahn fails to teach that said sub-matrices being obtained by subdivision of a unitary square matrix, wherein each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, and wherein the signal forms, seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix, wherein the method implements at least one receiver antenna, receives said single combined signal on each of said receiver antennas, and decodes said single combined signal by means of the decoding matrix corresponding to a matrix that is the conjugate transpose of said unitary matrix.

However, Wong does. (See section 2 & fig. 1) Wong discloses that said sub-matrices being obtained by subdivision of a unitary square matrix, wherein each of said antennas sends sub-vectors, obtained by subdivision of said vectors, respectively multiplied by said sub-matrices, and wherein the signal forms, seen from a receiver, a single combined signal representing the multiplication of said vectors by said unitary matrix, wherein the method implements at least one receiver antenna, receives said single combined signal on each of said receiver antennas, and decodes said single combined signal by means of the decoding matrix corresponding to a matrix that is the conjugate transpose of said unitary matrix.

Therefore, taking the combined teachings of Ahn and Wong as a whole, it would have been obvious to one of ordinary skills in the art to incorporate these features into the system of Ahn, in the manner as claimed and as taught by Wong, for the benefit of optimizing the communication link between the base station and mobile station.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Horng et al. (US Patent 7,263,132 B2)
- Sim et al. (US Patent 7,266,157 B2)
- Stuber et al. (US Patent 7,269,224 B2)
- Bertrand M. Hochwald et al. "Unitary Space-Time Modulation for Multiple-Antenna Communications in Rayleigh Flat Fading" IEEE 2000.

- Xue-Bin Liang et al. "Unitary Signal Constellations for Differential Space-Time Modulation with Two Transmit Antennas: Parametric Codes, Optimal Designs, and Bounds" IEEE 2002.

Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEON FLORES whose telephone number is (571)270-1201. The examiner can normally be reached on Mon-Fri 7-5pm Alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/L. F./
Examiner, Art Unit 2611
November 21, 2008

/David C. Payne/

Supervisory Patent Examiner, Art Unit 2611